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Water Quality of the

NEWLANDS RECLAMATION PROJECT

Agricultural Research Service

UNITED STATES DEPARTMENT OF AGRICULTURE

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WATER QUALITY OF THE NEWLANDS RECLAMATION PROJECT[1/]

by

Myron B. Rollins[2/]

INTRODUCTION

History

The Newlands reclamation project is located in the center of a broad, flat, desert valley in western Nevada. The valley is entirely surrounded by mountains and has no external drainage. The Carson River flows eastward into the valley from the Sierra Nevadas and terminates in two playa lakes; the Carson Sink, north of the town of Fallon, and the Carson Lake, to the south. Most of the land in the project lies between the two lakes (see fig. 1).

The valley, known in early days as the Carson Desert, is located near the eastern slope of the Sierra Nevadas and as a result, lies in a rain shadow. This means that the area has scarcely more than 5 inches of rainfall annually.

Because of the scarcity of rainfall, agriculture is possible only under irrigation. For this reason, early settlers homesteaded along the Carson River, where irrigation water was easily accessible. But the supply of water from the river proved to be too erratic to support a stable agriculture. Flooding occurred in the spring, followed by little or no water by late summer. There was a definite need for a more dependable water supply if crop yields were to be adequately high. The Newlands reclamation project originated from this need.

The Newlands reclamation project, among the first five of its kind, was a result of the Reclamation Act of 1902. The project was named after the late Senator Francis G. Newlands, of Nevada, who worked for passage of the Reclamation Act.

1/ Contribution from the southwest branch, Soil and Water Conservation Research Division, Agricultural Research Service, U. S. Department of Agriculture, in cooperation with the Nevada Agricultural Experiment Station.

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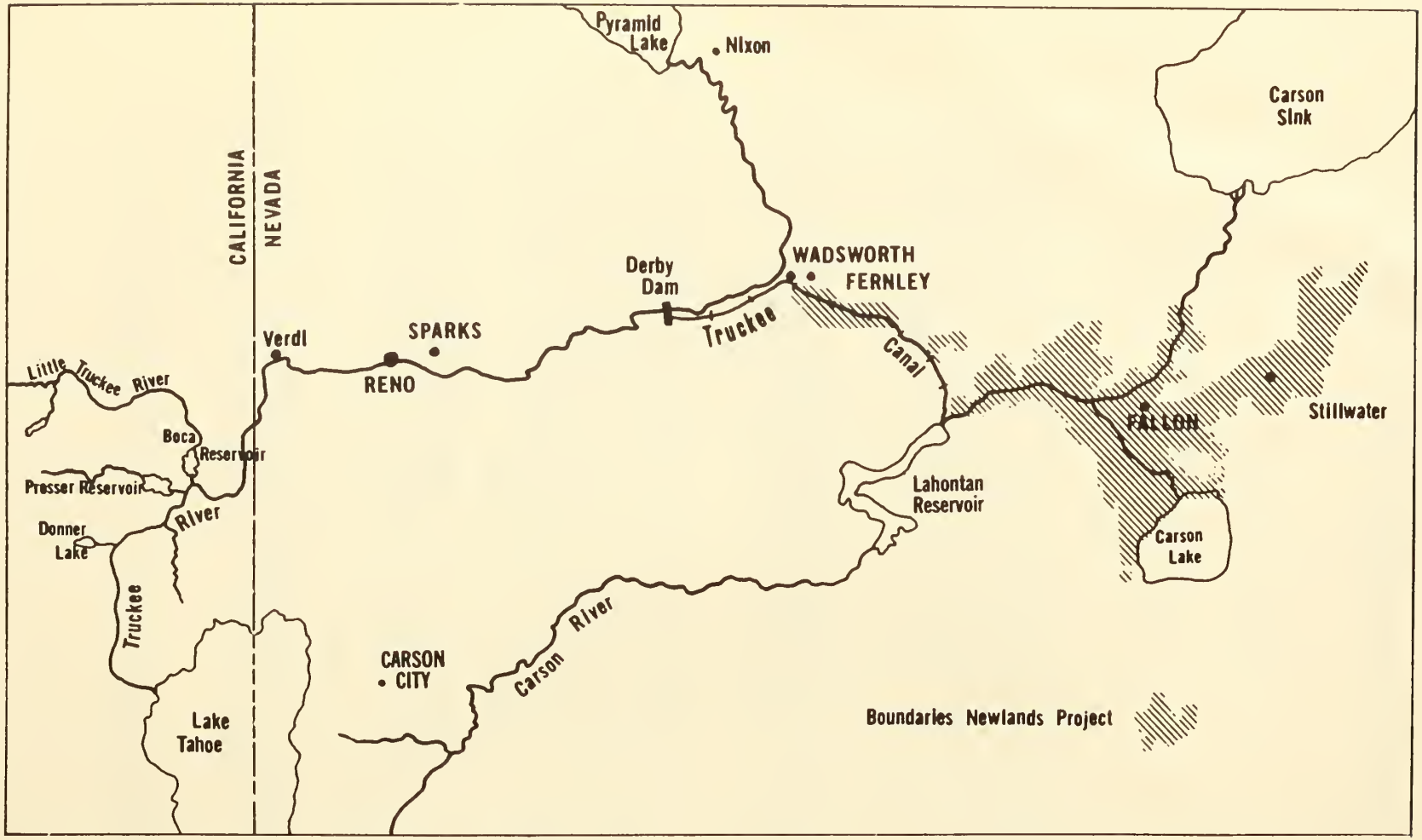

Figure 1. Location of Newlands reclamation project.

Initial plans were to divert water from the Truckee River to the Carson River. By adding to the flow of the Carson, it was felt that extra water would stabilize present irrigation and even allow further homesteading in the valley. The Truckee Canal was constructed for this purpose. It was completed in June 1905. With what appeared to be sufficient water, public lands were opened by the United States Government to homesteading entry in May 1907.

By 1909 it appeared the area would flourish, but 1910 brought a serious drought. The Carson River was completely dry in July and the water from the Truckee River was in short supply. The settlers' farming enterprises suffered a setback. Construction of a reservoir was soon considered essential.

Lahontan Reservoir, which can store 294,000 acre-feet of irrigation water for the project, was completed by June of 1915. The reservoir is located on the Carson River where the Truckee Canal joins the river.

The Truckee-Carson Irrigation District, organized in November 1918, took charge of operation and maintenance of the project on January 1, 1927. The Newlands reclamation project now includes about 72,000 acres of water-right land.

Continued irrigation has brought high water table problems, necessitating deep drainage. The first deep (6-ft.) open drains were constructed in 1920, and construction of drains has been continuous since that date. Now, much of the drainage water in the project is diverted into canals for irrigation reuse.

In the summer of 1959, the Soil and Water Conservation Research Division of the Agricultural Research Service, U. S. Department of Agriculture, in cooperation with the Nevada Agricultural Experiment Station and the Truckee-Carson Irrigation District, began a study of the water quality of the Newlands reclamation project.

Importance of Water Quality in Irrigation

All irrigation waters contain dissolved salts. The kind and amount of these salts determine irrigation water quality. Some salts give irrigation water excellent quality; other salts are detrimental. Calcium and magnesium salts, in moderate amounts, add good properties to irrigated soil: they give the soil good tilth, which permits water to penetrate easily. Sodium salts destroy these desirable properties, and as their concentration in the soil increases, will even become toxic to some plants, (1, 2).3/ In fact, most salts at high concentrations in the soil will inhibit plant growth. Excessive amounts of carbonates and bicarbonates in

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3/ Underscored numbers in parentheses refer to Literature Cited.

irrigation waters can also be hazardous by causing precipitation of calcium and magnesium during the soil drying process after irrigation. This increases the proportion of sodium ions in the soil solution and subsequently increases the sodium hazard.

Other salts are detrimental even at low concentrations. For example, the upper limit of boron tolerance of agricultural crops ranges from 0.5 to 4 p.p.m. (6, 7). In addition to the effect on crops and croplands, salts can also have a deleterious effect on concrete or earthern canal linings.

The only canal lining being used in this project at present is made of concrete (used to a limited extent). Water quality could have an influence on the type and amount of canal linings used on this project in the future.

Objectives of Study

The objectives of the study described in this paper were to: (1) determine the present quality of irrigation water within the project; (2) determine the quality of drainage waters and their suitability for irrigation; (3) determine the changes of irrigation and drainage waters as they move downstream through the project; (4) determine the seasonal changes in the quality of irrigation and drainage waters; (5) estimate past and future changes in water quality; (6) estimate changes in soil properties of irrigated lands due to changes in water quality; and (7) predict the effects of water quality upon canal linings.

PROCEDURES

To achieve the objectives of the study, sampling stations were selected to represent various areas of the irrigation and drainage systems. Stations were located at the waters feeding Lahontan Reservoir, and along the canals and drains within the main project area (see fig. 2.) (Water sampling stations selected near Lahontan Reservoir are not shown in figure 2 but can be approximately located in figure 1 by using descriptions from the analysis tables in the appendix.)

Water samples were collected each month from August 1959 to May 1961, except for a few months in the winter season of 1959-60. In addition, samples were collected in April 1962 prior to the irrigation season.

The waters analyzed in this study are classified according to a classification system currently in use by the U.S. Department of Agriculture (5, 6). The classification is based on the content of total salts and sodium since these two factors largely determine the quality of most irrigation waters. Appendix figure 7 [adapted from (5)] was used to classify each water sample analyzed in this study.

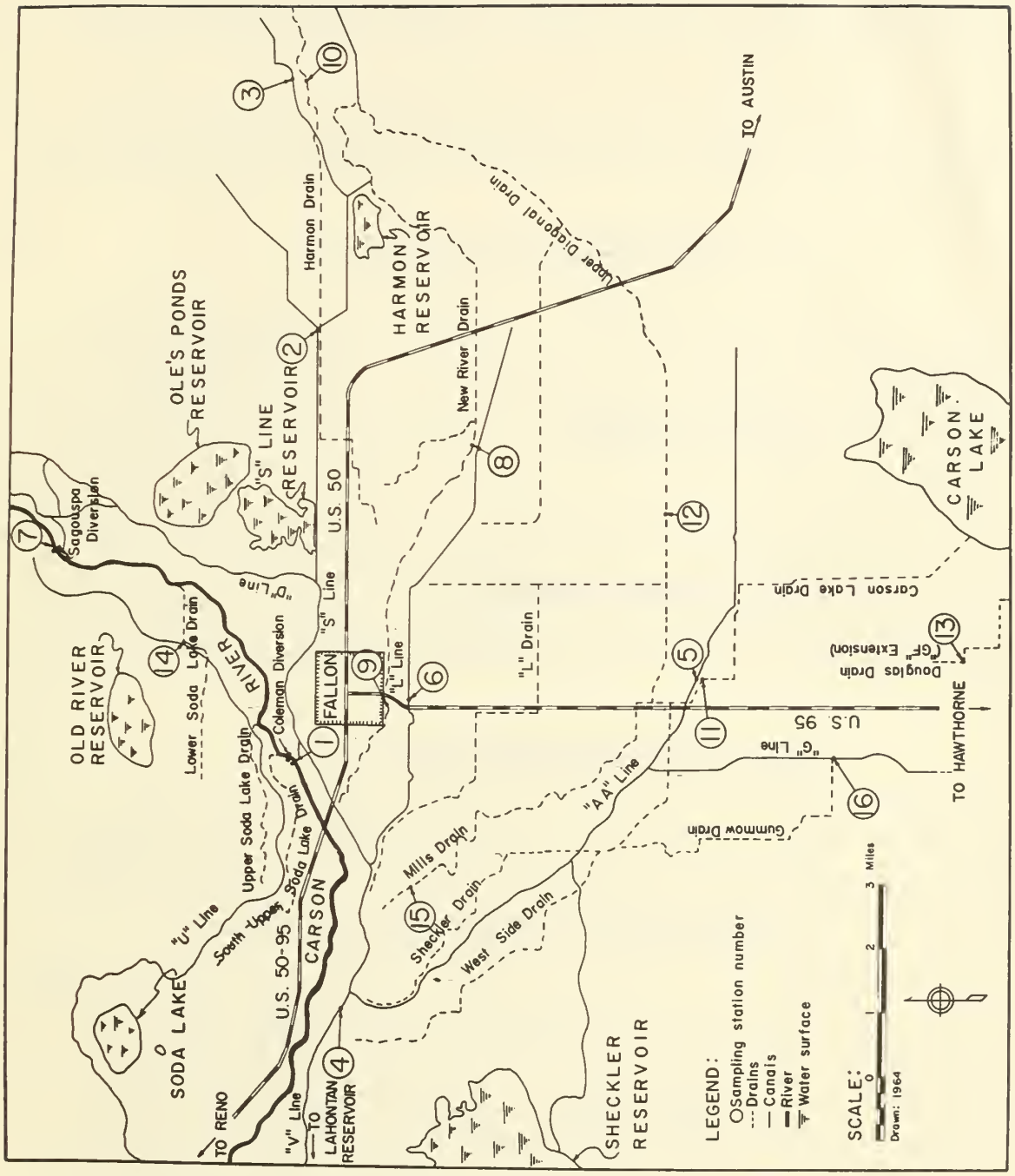

Figure 2. Location of water sampling stations within the Newlands project. This map excludes surrounding areas shown in figure 1.

In classifying an irrigation water, it is assumed the water will be used under average conditions with respect to soil texture, infiltration rate, drainage, quantity of water used, climate, and salt tolerance of the crop. Large deviations from one or more of these average conditions may render the classification erroneous and subsequent management of a water ineffective.

More information concerning the classification system, method of sampling, analytical procedure, and definition of terms in this report are found in the appendix.

RESULTS AND DISCUSSION

The study was conducted during a drought (1959-61), which undoubtedly affected the amount and kind of salts in the irrigation and drainage waters. The extent of the drought may be ascertained from figure 3, which shows maximum and minimum storage in Lahontan Reservoir from 1958 to 1962 inclusive. Actually, only 1960 and 1961 were low water years, owing to a large carryover to the 1959 irrigation season from 1958.

The low water supply during 1960 and 1961 caused a slight increase in the concentration of salts in the irrigation water and a substantial increase in the concentration of salts in the drainage waters. The salt increase in the drainage waters was especially noticeable at the close of the 1961 season and in the spring of 1962 prior to irrigation. Analytical results for each water sample taken are listed in the appendix.

Irrigation Water Quality

Irrigation water of the Newlands project, originating in the Truckee and Carson River watersheds is of good quality. It has a medium salinity hazard and practically no sodium hazard [see (5), pp. 79-81 for classification terminology]. Analyses of irrigation water samples tested in this study are shown in appendix tables 2 to 12.

The watersheds of the Truckee and Carson Rivers are composed largely of insoluble granitic rock. The average annual precipitation is high and runoff is large. As a result, the waters of these streams contain low concentrations of salts. Water samples from the Truckee Canal, which diverts water from the Truckee River into the reservoir, ranged from 77 to 237 p.p.m., in total salts (appendix table 2). The concentration of salts in this canal water was seldom above 200 p.p.m., which is nominal for an irrigation water. The Carson River carried a higher concentration of salts, but water quality was still good. Total salts in this water ranged from 166 to 442 p.p.m. (appendix table 3). Both waters contained low concentrations of sodium.

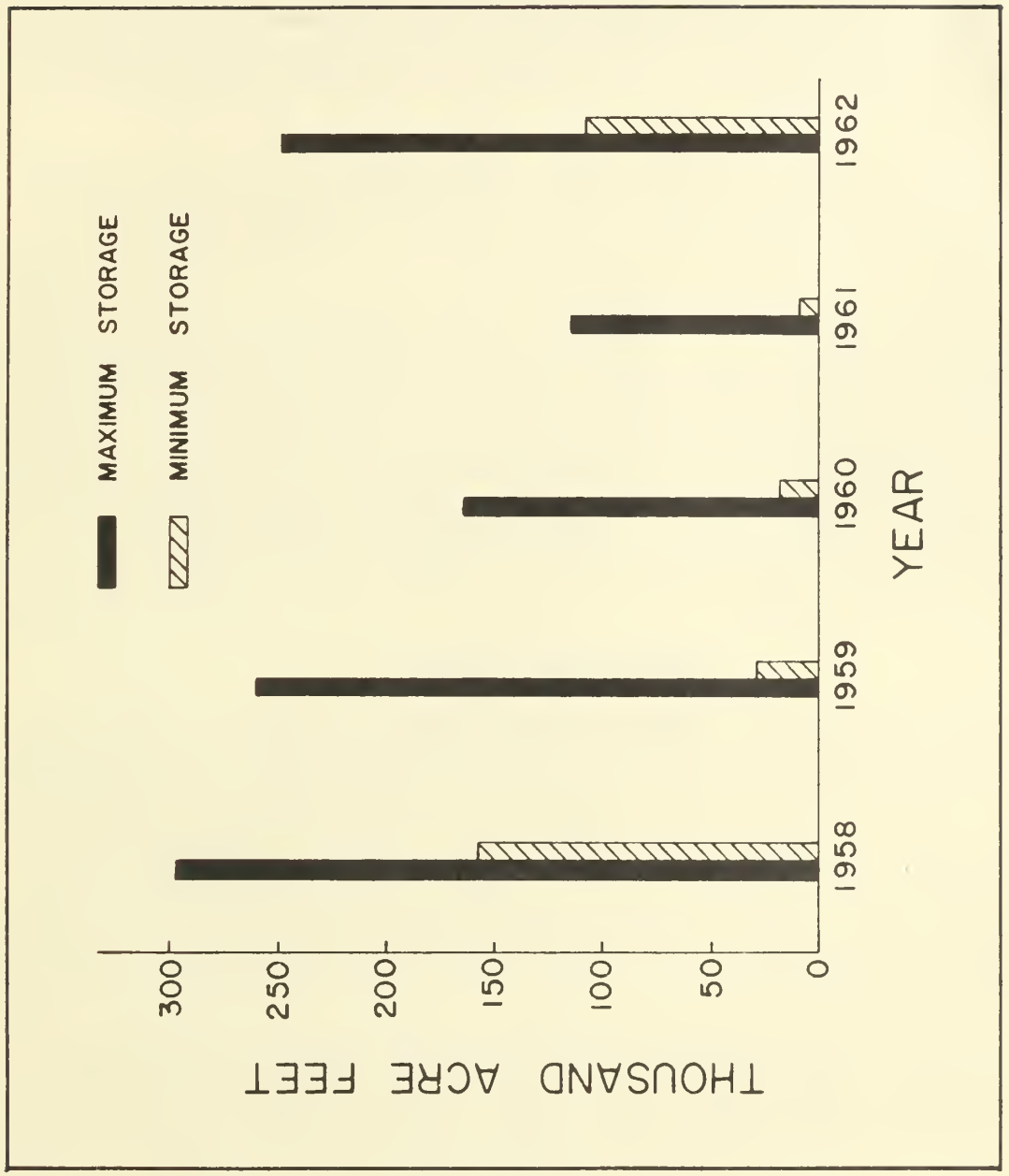

Figure 3. Maximum and minimum storage in Lahontan reservoir, 1958-62; drought years are 1959-61.

These waters, when mixed together in Lahontan Reservoir, contained dissolved salts ranging from 160 to 294 p.p.m. (appendix tables 4 and 5). The samples were taken in the reservoir near the gatehouse and in the Carson River below the reservoir outlet.

The irrigation waters in canals below the reservoir carried a slightly higher concentration of total dissolved salts, ranging from 141 to 596 p.p.m. But most irrigation waters seldom exceeded 300 p.p.m. in total salts unless excessive drainage water was diverted into the irrigation canals. The irrigation water throughout the project contained low concentrations of sodium.

Each salt measured was found to be well below toxic levels in all of the irrigation water samples. Water samples tested for boron prior to this study had less than 1 p.p.m. of boron, which is well below toxic levels for crops grown in the project.

The carbonates and bicarbonates of the irrigation water were well below dangerous concentrations during the irrigation season (see discussion in appendix); therefore there should not have been any sodium hazard due to precipitation of calcium and magnesium in the soil solution. But during the winter, when the proportion of water in the canals that comes from drainage increases, the concentration of bicarbonates increased sufficiently to cause the sodium content to reach dangerous proportions during the soil drying process. This increase in concentration of bicarbonates was especially evident in April 1962, prior to the irrigation season and at the close of three drought years.

Drainage Water Quality

The drainage waters contained higher concentrations of total salts and a higher percentage of sodium than the irrigation water. Most drains carried salts at concentrations between 400 and 600 p.p.m., but the measurements ranged between 320 and 45,500 p.p.m. The extremely high salt concentrations were found in the Douglas drain [("GF" extension) sampled at station 13], a relatively new drain constructed in 1952 through highly saline alkali land. As the leaching continues, the concentration of salts carried in this drainage water should diminish. The only other drains containing extraordinarily high salts were the Harmon drain (sampled at station 10) and the upper Diagonal drain (sampled at station 12). Total salts in these drains reached a high of 4,690 and 6,650 p.p.m., respectively, in the spring of 1961. One other drain, the lower Soda Lake drain (sampled at station 14), exceeded the usual 400 to 600 p.p.m. of total salts in the drainage waters. This drain varied from 512 to 883 p.p.m. in total salts.

Those drainage waters low in salts were also low in sodium. Conversely, those drainage waters high in salts were also high in sodium. Many of the drainage waters high in salts and sodium also contained dangerous levels of carbonates and bicarbonates. Analytical results of the drainage waters are shown in appendix tables 13 through 21.

Storage reservoirs (which collected mostly drainage water during the winter) in the valley were sampled once, in April 1962. The analyses showed total salts to vary from 346 to 640 p.p.m. This range is about the same as the better drainage waters of the project. The concentrations of sodium was low in all of the reservoirs, but the concentration of bicarbonates was dangerously high because of the preceding drought. Sodium from these waters could, therefore, become hazardous in the soil solution, although this should not happen during normal water years. Analytical results of the valley storage reservoir waters are shown in appendix table 22.

Downstream Quality Changes

The water analyses presented in this publication show there is only a small change in quality of irrigation water as it flows downstream, except where drainage waters are diverted into the canals.

There was no noticeable change in total salts between Lahontan Reservoir and station 4 on the "V" line canal. There was, however, an increase in salts between the reservoir outlet and the Coleman Diversion (station 1) on the Carson River. This is undoubtedly due to drainage waters entering the river between these points. There was also a small increase in salts between stations 4 and 5 on the "AA" line canal but no apparent increase between stations 4 and 6 on the "L" line canal (see fig. 2). There was also no apparent increase in salts between the Coleman Diversion (station 1) and station 2 on the "S" line canal, but there was a noticeable increase in salts further downstream between stations 2 and 3 on this canal.

The Carson River increased in salts between the Coleman Diversion (station 1) and Sagouspa Dam (station 7). This was particularly noticeable during the winter season, primarily because of large amounts of drainage water entering the river between these two locations.

The change in sodium content of water in the irrigation system was less apparent than the change in total salts. The only noticeable increases in sodium were between the Coleman Diversion and Sagouspa Dam. Here again, the change was undoubtedly due to increase of drainage water at Sagouspa Dam.

All drainage waters tested increased in salt content and proportion of sodium as they flowed downstream, picking up surface and subsurface return flow from irrigated lands. There was a substantial increase in salts and sodium percentage between station 15 on the Mills drain and both station 11 on the Carson Lake drain and station 12 on the upper Diagonal drain. There was only a slight increase in total salts and sodium between

stations 9 and 8 on the New River drain. But a substantially higher concentration of salt with a higher proportion of sodium was found in the lower end of the Harmon drain (station 10). The drainage waters in the center of the project, particularly south of the Carson River, appeared to be free of excessive salts. But there was, however, a rapid increase in total salts as the drainage waters approached the Carson Lake and Carson Sink areas.

Furthermore, drains immediately north of the river picked up substantial amounts of salt. The lower Soda Lake drain was consistently high in salts and the water in the Carson River at Sagouspa Dam was very high in salts whenever irrigation water was absent.

Seasonal Quality Changes

Figure 4 shows that electrical conductivity (total salts) of the irrigation water steadily increased from March to October of 1960. This was most likely due to the concentration of salts by evaporation of water from Lahontan Reservoir and from the distribution system, and to increasing quantities of drainage waters in the irrigation system. It would, therefore, be reasonable to assume that total salts increase each year as the season progresses, then decrease as large volumes of low-salt spring runoff replenish the reservoir supply and dilute the salt concentration of the irrigation water. Diversion of Truckee Canal water directly into the Carson River at any time will cause a decrease in total salts of the water in the irrigation system, especially when outflow from the reservoir is shut off during the winter. This accounted for the drop in total salts after October 1960. The higher concentration of salts in the irrigation water in the spring of 1961 was undoubtedly due to the small volume of higher-salt-concentration runoff stored in Lahontan Reservoir at that time, (see fig. 5 and appendix tables 3 and 5). This relatively small volume of high-salt runoff would occur during drought periods as well as during low runoff seasons of the year.

The soluble sodium percentage of the irrigation waters fluctuated during each season, but was noticeably higher during the low water years of 1960 and 1961. This is evidence that sodium percentage also varies with volume of water supply.

The concentration of salts in the drainage waters was low in the summer months, increasing sharply at the termination of the irrigation season (fig. 6). Total salts continued to increase through the winter until irrigation and consequent dilution of the drainage waters was started again in the spring. This seasonal fluctuation in total salts was verified by analyses made in April 1962, prior to the irrigation season (analyses results also shown in fig. 6).

Observation of the average sodium concentration of the drainage waters (see fig. 6) shows what can happen under prolonged drought conditions. Although the concentration of sodium fluctuated throughout the

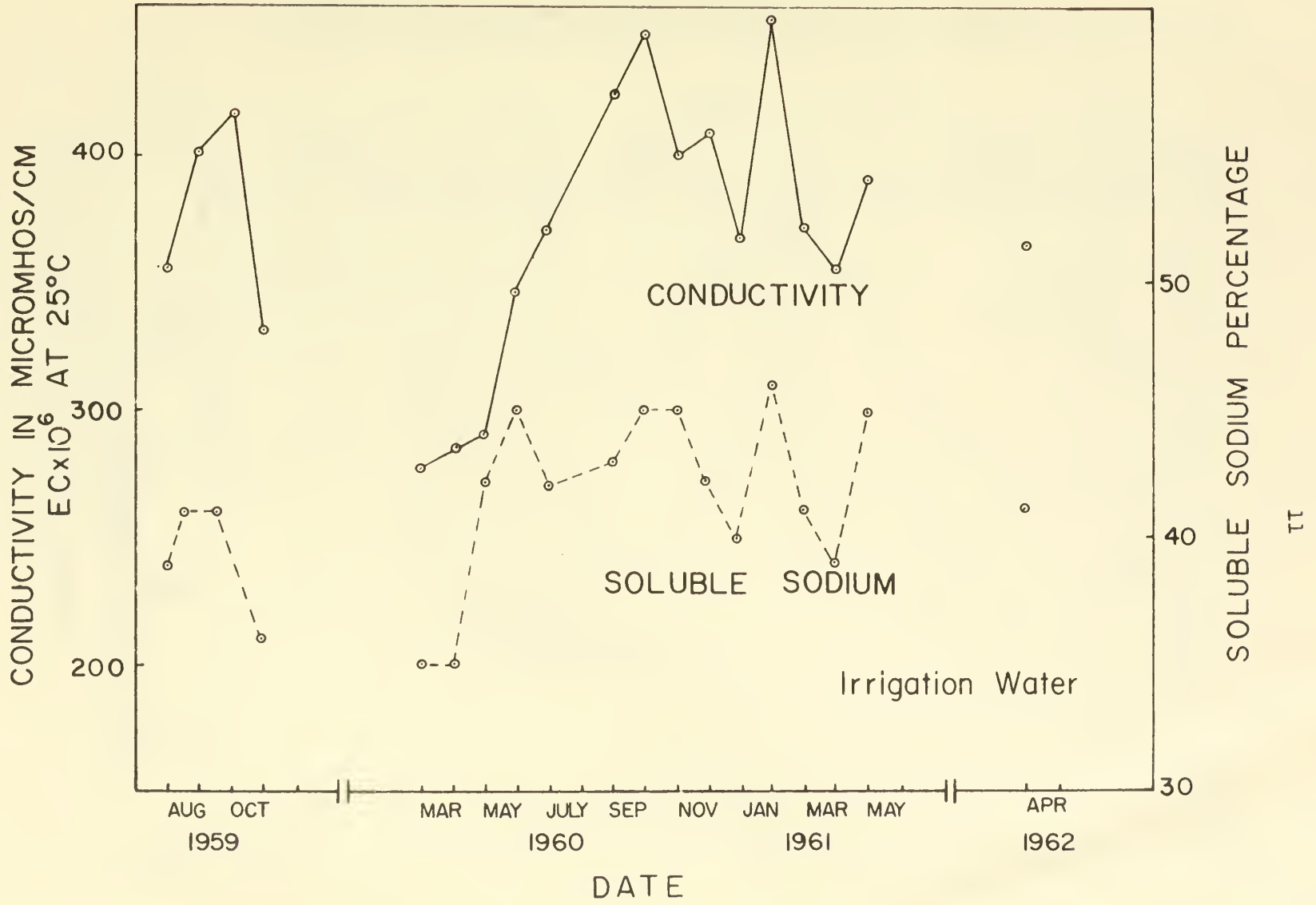

Figure 4. Fluctuation of electrical conductivity (total salts) and soluble sodium percentage of irrigation water used on Newlands reclamation project during period of study. Data points are averages of all irrigation water samples collected on each sampling date.

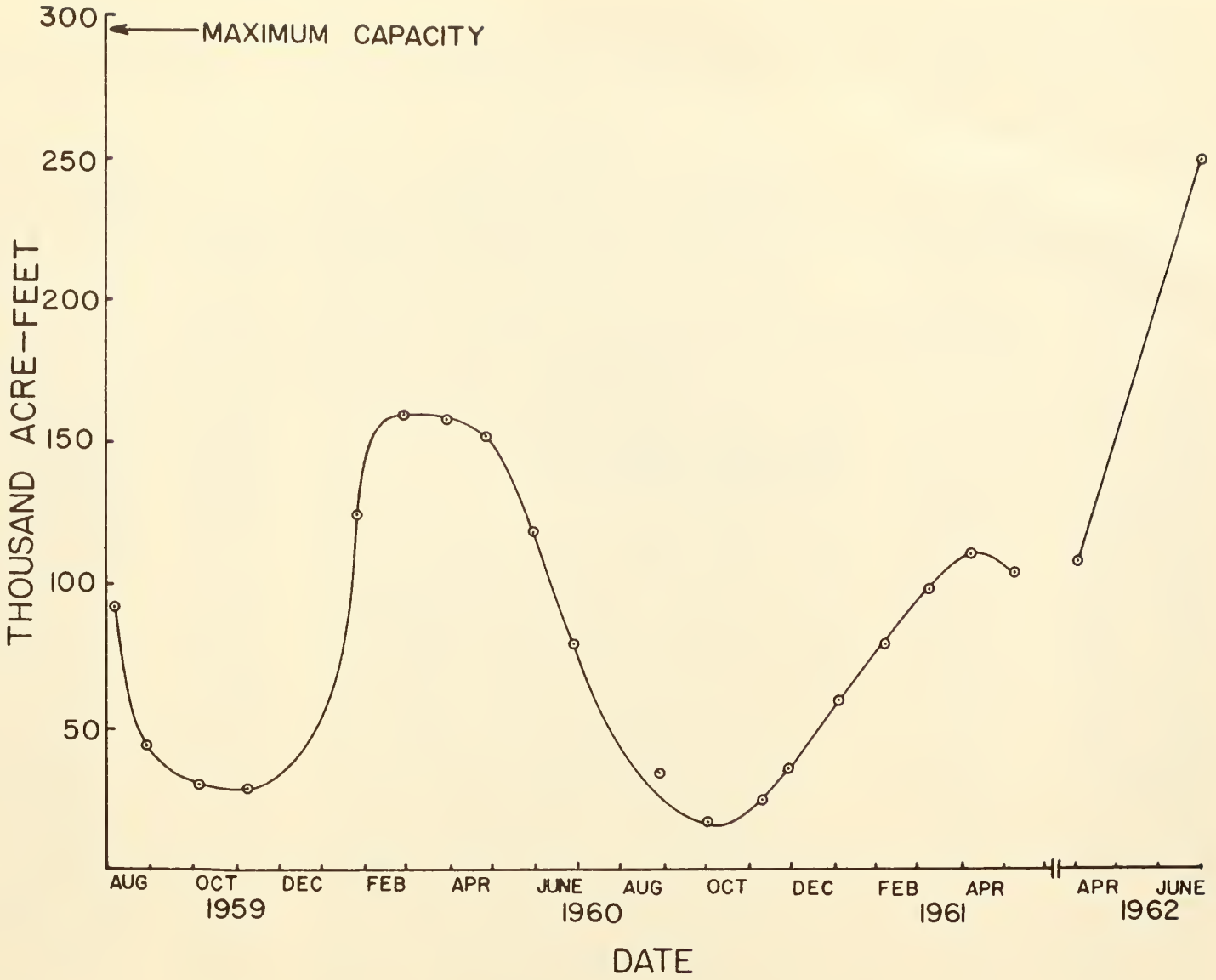

Figure 5. Fluctuation of volume of water in Lahontan reservoir during period of study. Data points show volumes on dates irrigation and drainage waters were sampled for analysis.

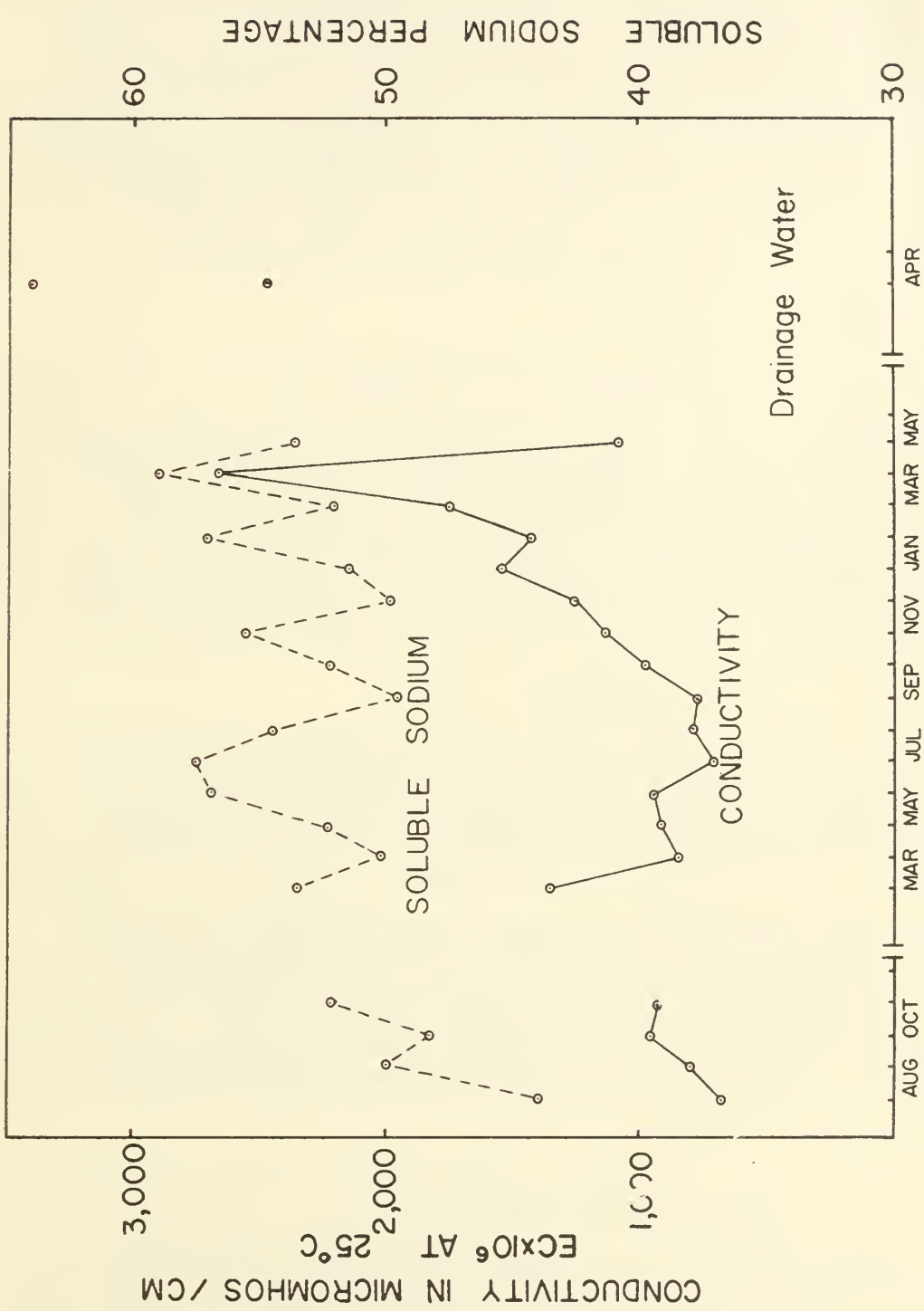

Figure 6. Fluctuation of electrical conductivity (total salts) and soluble sodium percentage of drainage waters collected in Newlands reclamation project during period of study. Data points are averages of all drainage water samples collected on each sampling date.

test period, there was a substantial increase in the average concentration of sodium between 1959, the first year of the study (also the first of three drought years), and April 1962. This can be seen better by comparing analyses of February 26, 1960, April 6, 1961, and April 2, 1962 (fig. 6), which are the analyses made prior to each irrigation season. Total salts increased in the same manner. This indicates that over a prolonged drought, the level of sodium and total salts in drainage water, particularly at the lower end of drains, may increase to such a degree that these waters become unsuitable for irrigation. Waters in the Newlands reclamation project discussed in this publication, are probably of subnormal quality, because of drought conditions during the period of study. A normal water supply should yield slightly better quality irrigation water and substantially better quality drainage water.

Past and Future Quality Changes

It is doubtful if the quality of the irrigation water has changed noticeably since this project's beginning in 1905. The chemical composition of water from this project's watershed would not change in such a short period without a major change in climatic conditions. But the quality of the drainage water has probably changed significantly in that time, improving over the years. Initial leaching of salts from irrigated lands would normally be rapid and then taper off until an equilbrium was reached between the amount of irrigation water applied and the amount of salts removed in the drainage water.

Water from the new Douglas ("GF" extension) drain (station 13) is an example of poor quality water from a newly constructed drain. Within the present system of canals and drains, the quality of irrigation and drainage water should be virtually stabilized, although new drains constructed in the future through areas of salt- or sodic-affected soils could be expected to contain poor quality drainage water for a short time.

Another factor contributing to water quality should be considered. In the future, water available for irrigation may decrease because of appropriation for uses of higher priority (domestic, industrial, etc.). This will necessitate a more efficient use of irrigation water, which will decrease drainage flow and increase the concentration of salts in drainage waters and reservoirs. An increase in salts in some drainage waters (now used for irrigation in the project) would cause these waters to become hazardous for continued irrigation.

Changes in Soil Properties

Soil salinity and alkalinity of irrigated lands of the Newlands reclamation project should be nearly stabilized under the present irrigation and drainage systems. Changes in soil salts will be slow in the future, except

where new drains are constructed. Caution should be exercised in this valley to prevent overirrigation, which would cause the water table to rise excessively. A high water table not only increases the movements of salt toward the surface of the soil, but injures roots of growing plants. Irrigation practices should be designed to keep the water table down to at least 4 or 5 feet below the surface of the soil, except for short periods when accumulated salts are being leached out. A deeper water table would be desirable, but because of inherent soil conditions in the valley, this would not be easily achieved in many areas.

Effects of Water Quality Upon Canal Linings

Little is known at present about the effects of water quality upon canal liners. Concrete liners may be decomposed by sulfates at high concentrations (4). Other liners, such as plastics, are believed to be rather inert to chemicals found in water. The bentonite or clay used to seal canals may be flocculated by water of very high salt content or their structure may be altered by the chemicals in the water. Therefore, water quality should be considered in the selection of canal liners or sealers. The irrigation waters of the Newlands reclamation project should not harm most canal liners now in use, but some of the drainage waters of high salt content could shorten the life of some types of liners.

Irrigation Management

The irrigation water of the Newlands reclamation project is of good quality during the irrigation season and should not harm any crop suited to the climate and soils of the project. With a moderate amount of leaching with this water, there is little danger of salt buildup in irrigated soils. (see (5) pp. 79-81 for more detailed information on management.)

Since it is common practice throughout this project to use most drainage waters for irrigation, special attention should be given to proper management practices in order to prevent a saline or alkali condition from developing in the soils irrigated with these waters. Table 1 lists the salinity and sodium hazards of the major drainage waters of the project. The following paragraphs are recommendations for their use as irrigation waters.

Water from the New River drain at station 9 and the Mills drain at station 15 can be used for irrigation on almost all soils if a moderate amount of leaching is done with it. In most cases, plants with moderate salt tolerance can be grown without special practices for salinity control. There is little danger that harmful levels of exchangeable sodium will develop in soils irrigated with these waters.

Table 1. Salinity and sodium hazards of major drainage waters in the Newlands reclamation project[1/]
(Summer 1959 to Winter 1961-62)

Drain	Station No.	Summer		Winter	
		Salinity hazard	Sodium hazard	Salinity hazard	Sodium hazard
New River	9	Medium	Low	Medium	Low
Mills	15	do	do	do	Do
New River	8	do	do	High	Do
Carson Lake	11	do	do	do	Do
Gummow	16	do	do	do	Do
Lower Soda Lake	14	High	Low to medium	High	Low to medium
Carson River at Sagouspa Dam	7	do	Low	Very high	Very high
Upper Diagonal	12	do	do	High	Low to very high
Harmon	10	do	Low to medium	Very high	High to very high

1/ Salinity and sodium hazard ratings are based on appendix figure 7.

Water from the New River drain at station 8, the Carson Lake drain at station 11, and the Gummow drain at station 16 can be managed in the same manner as the water from the two preceding drains, with certain exceptions. If these waters are used in the winter upon land which has restricted drainage, a salt buildup will occur. Because of high levels of carbonates and bicarbonates in these waters there is also some danger of a sodium hazard developing in soils irrigated with them during the winter months.

Water in the Carson River at Sagouspa Dam (station 7), which contains a large amount of drainage water, including water from the lower Soda Lake drain at station 14, should not be used on land with restricted drainage. Even with adequate drainage, only salt-tolerant plants would do well, particularly during low water years. It would be extremely detrimental to place this water upon good land during the winter except under special circumstances (listed in the following discussion of upper Diagonal and Harmon drains).

The waters at the upper Diagonal drain at station 12 and at the Harmon drain at station 10 vary in quality with seasonal fluctuations in flow of and extent of dilution of irrigation water. These drainage waters are generally not suited for irrigation on good land, but may be used under special circumstances: the soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching, and crops must be salt-tolerant. During the winter these waters should never be placed upon good land; they are suitable then for saltgrass pasture irrigation or waterfowl.

The foregoing recommendations are made for drainage water samples taken at specific locations. The water used for irrigation at other locations will be of different quality and will therefore require different management. The foregoing discussions on changes in the water quality as it flows downstream and seasonal changes in quality should be helpful in determining water quality at other locations in the drainage system.

SUMMARY AND CONCLUSIONS

All irrigation waters contain dissolved salts. The kind and amount of salts in irrigation water determine its quality. Objectives of this study were to determine the quality of the irrigation and drainage waters of the Newlands reclamation project and the changes in irrigation water quality as it flowed downstream. This work was also concerned with changes in quality with season, and an attempt was made to estimate past and future changes in water quality and the effect of water quality upon soil properties and canal linings.

The irrigation water of the Newlands reclamation project is of good quality. The water has a medium salinity hazard and practically no sodium hazard. A moderate amount of leaching with this water should prevent any salt buildup in irrigated soils. Apparently, there is only a small change in irrigation water quality as it flows downstream, except where drainage waters are diverted into canals.

This study shows that salinity of irrigation water increases slightly each year as the irrigation season progresses. Then salinity decreases as large volumes of low-salt spring runoff replenish the reservoir supply.

The drainage waters contain higher concentrations of total salts and higher percentages of sodium than the irrigation water. These drainage waters vary in quality from a medium salinity and low sodium hazard to a very high salinity and sodium hazard.

Drainage waters increase in salt concentration and percentage of sodium as they flow downstream. Apparently, the drains in the center of the project, particularly south of the Carson River, are free from excessive salts. But they pick up salts rapidly as they approach the Carson Lake

and Carson Sink areas. Conversely, those drains immediately north of the Carson River carry high concentrations of salts.

Seasonal changes in quality were more pronounced with the drainage waters than with the irrigation water. At the termination of the irrigation season, the drainage waters increased sharply in total salts and continued to increase through the winter until irrigation was started again in the spring. For this reason, most drainage waters should not be placed upon good land during the winter.

It is a common practice in the Newlands reclamation project to use most drainage waters for irrigation. Some drainage waters are excellent for irrigation while others can be used successfully with careful management. But some drainage water in the project should never be placed upon good land.

The concentration of both total salts and sodium in the drainage waters continued to increase through the study period. This is attributed to drought conditions during that time. It is possible that during prolonged droughts, the drainage waters would increase in sodium and total salts until they become dangerous to use for irrigation, particularly at the lower ends of the drainage system. Reduction in the amount of water available for irrigation would also cause this same condition to develop.

The irrigation waters of the Newlands reclamation project should not harm most canal liners now in use, but some of the drainage waters, of high salt concent, could shorten the life of some types of liners.

Soil salinity and alkalinity are nearly stabilized on this project under the existing irrigation and drainage systems. Overirrigation, which causes the water table to rise excessively, should be avoided.

It is doubtful whether irrigation water quality has changed in the Newlands reclamation project since its beginning (1905). But the quality of the drainage water has most likely changed since then, becoming better with time, then gradually stabilizing.

Irrigation water of the Newlands reclamation project should continue to be of high quality unless its supply is reduced in the future, thereby necessitating an increase in the proportion of drainage water used for irrigation.

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APPENDIX FOLLOWS

APPENDIX

Sampling Method

Water samples were taken with a glass sample bottle clamped to the end of a long handle. The sample was taken as near as possible to the center of the flowing stream of water. (3)

Analytical Procedures

Electrical conductivity was determined with a model RD-26 Solu Bridge Soil Tester[4/] and recorded as micromhos per centimeter (EC x 10^6).

The hydrogen ion concentration (pH) of each sample was measured with a Beckman Model M pH meter.

Calcium plus magnesium was determined by titration with disodium ethylenedinitrilotetraacetate (Versenate) using Eriochrome Black T as an indicator [(5), p. 94].

Potassium and sodium were analysed with a Beckman model DU flame photometer.

Carbonates and bicarbonates were determined by titration with standard acid and the chlorides were determined with silver nitrate [(5), p. 98]. Other anions, presumed to be largely sulfates, were estimated by difference.

Symbols, Formulas, and Definitions

Ions	Chemical symbol	Gram equivalent weight
Calcium	Ca^{++}	20.04
Magnesium	Mg^{++}	12.15
Sodium	Na^{+}	23.00
Potassium	K^{+}	39.10
Carbonate	$CO_3^{=}$	30.00
Bicarbonate	HCO_3^{-}	61.01
Chloride	Cl^{-}	35.46

4/ Trade names are used in this publication solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

$EC \times 10^6$ = Electrical conductivity in micromhos per cm. at 25°C. Electrical conductivity increases with salt content.

p.p.m. = Parts per million, or parts of salt by weight in a million parts of water.

The total salts recorded in p.p.m. in the tables of analyses were calculated from the electrical conductivity readings by using the following formulas:

p.p.m. = $0.64 \times EC \times 10^6$ when $EC \times 10^6$ was 5,000 or less; and

p.p.m. = $0.70 \times EC \times 10^6$ when $EC \times 10^6$ was above 5,000.

Sum of cations = total of four major cations, Ca^{++}, Mg^{++}, Na^{+}, and K^{+}, in milliequivalents per liter.

Meq./l. = Milliequivalents per liter = 1/1000 of the gram equivalent weight of a chemical substance per liter of water. A gram equivalent weight of a chemical substance will combine with or replace a gram equivalent weight of another chemical substance.

Milliequivalents per liter to p.p.m.: milliequivalents per liter x gram equivalent weight = p.p.m.

SSP = Soluble sodium percentage. Determined by dividing the sodium in milliequivalents per liter by the sum, in milliequivalents per liter, of the four major cations, and multiplying by 100.

SAR = Sodium-adsorption-ratio. This is the ratio of sodium to calcium and magnesium that is expressed mathematically in the following equation:

$$SAR = \frac{Na^{+}}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

Each ion is represented in milliequivalents per liter. The relationship of these three major cations determine the approximate amount of sodium that will be adsorbed by a soil from an irrigation water. The SAR is probably the best available index to estimate the sodium hazard of an irrigation water.

Appendix figure 7 [adapted from (5), p. 80] was used to classify the waters. It is designed to use the SAR to classify the sodium hazard and the electrical conductivity to classify the salinity hazard of irrigation waters.

RSC = Residual sodium carbonate = the amount of carbonate plus bicarbonate in excess of calcium and magnesium in meq./l.

$$RSC = (CO_3^{=} + HCO_3^{-}) - (Ca^{++} + Mg^{++})$$

The ionic concentrations in the above equation are expressed in milliequivalents per liter. Waters with RSC values above 2.50 meq./l. are hazardous for irrigation. Water with a RSC between 1.25 and 2.50 meq./l. may require good management to avoid sodium problems. Waters with RSC values below 1.25 meq./l. are probably safe for irrigation (5, 6)

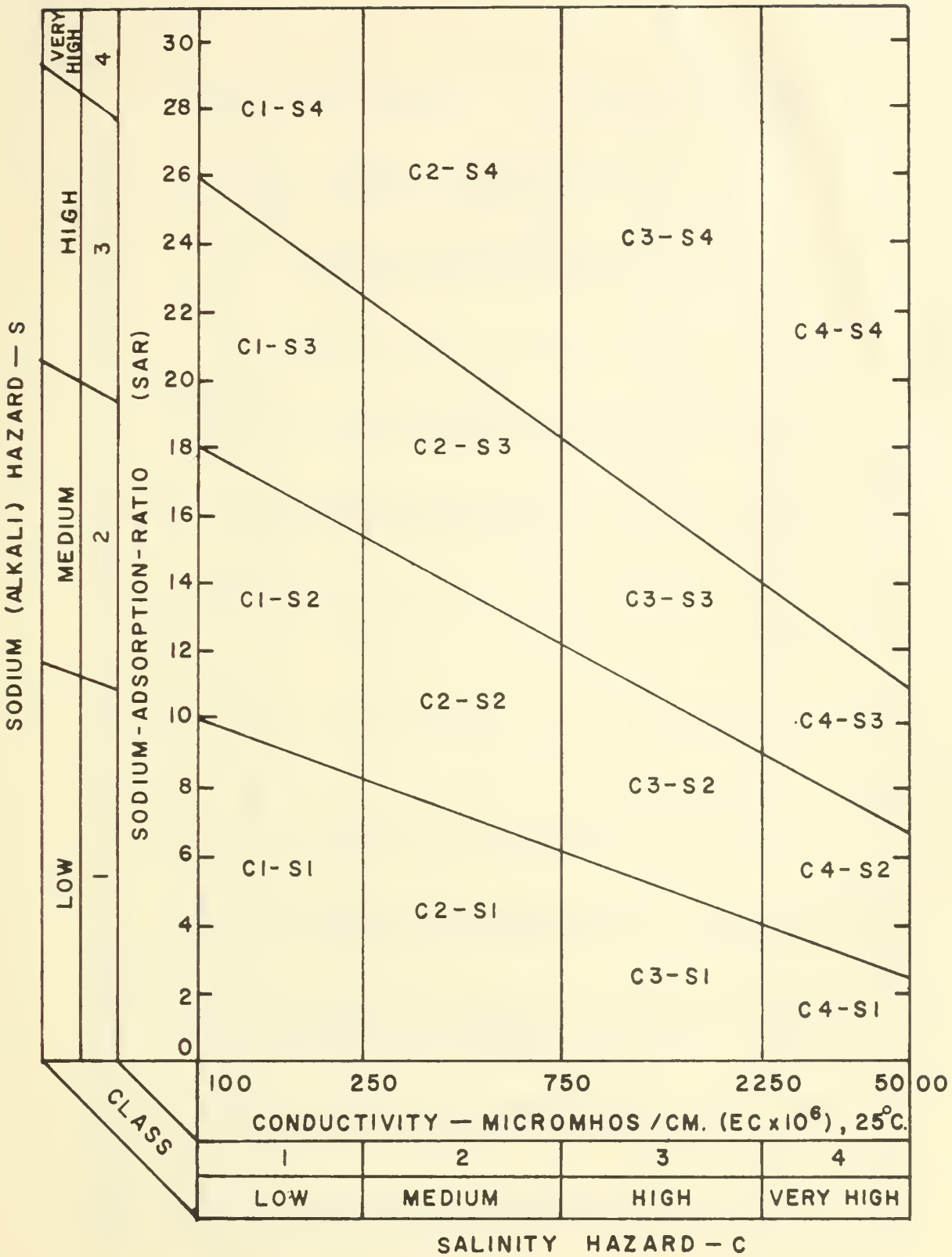

Figure 7. Diagram for the classification of irrigation waters.

[Adapted from p. 80 in Diagnosis and Improvement of Saline and Alkali Soils (5)]

Analyses of Water from Newlands Reclamation Project Sampling Stations

Table 2. Analysis of irrigation water sample: Truckee Canal at Lahontan Reservoir[1/]

Date sampled	EC$\times 10^6$ @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.
9/3/59	350	224	3.38	2.00	1.26	0.12	-	2.32	2.50	-	8.5	37	1	0.32
10/9/59	250	160	3.04	2.20	.80	.04	-	2.70	2.00	-	8.4	26	1	.50
11/9/59	220	141	2.22	1.40	.70	.12	-	2.80	1.90	-	8.2	32	1	1.40
2/26/60	210	134	5.03	4.10	.81	.12	-	2.30	1.74	0.99	8.1	16	1	0
3/30/60	120	77	1.35	1.05	.29	.01	-	2.35	1.74	-	8.2	21	1	1.30
4/29/60	200	128	2.85	1.92	.80	.13	-	3.55	3.45	-	8.3	28	1	1.63
5/24/60	180	115	1.93	1.20	.62	.11	-	2.99	2.90	-	8.0	32	1	1.79
6/29/60	240	154	2.55	1.48	.95	.12	-	2.33	.66	-	8.8	37	1	.85
7/29/60	240	154	2.60	1.60	.87	.13	-	2.36	.70	-	9.0	33	1	.76
9/1/60	250	160	2.22	1.70	.41	.11	-	2.46	.72	-	8.6	18	1	.76
10/4/60	260	166	2.69	1.62	.96	.11	-	2.30	.72	-	8.0	36	1	.72
11/9/60	330	211	3.39	1.70	1.56	.13	-	2.44	1.08	-	8.3	46	2	.74
12/1/60	250	160	2.38	1.40	.89	.09	-	1.98	1.00	-	8.3	37	1	.58
1/4/61	270	173	2.43	1.40	.94	.09	-	2.00	1.00	-	8.1	39	1	.60
2/8/61	370	237	3.49	1.72	1.66	.11	-	2.76	1.40	-	8.0	48	2	1.04
3/6/61	290	186	2.62	1.44	1.10	.08	-	2.16	1.14	-	8.1	42	1	.72
4/6/61	190	122	1.76	1.04	.63	.09	-	1.70	1.06	-	7.7	36	1	.66
5/8/61	290	186	3.52	1.54	1.85	.13	-	2.40	.80	.32	8.1	53	2	.86
4/2/62	170	109	1.58	.97	.54	.07	-	2.16	.21	-	7.7	34	1	1.19

1/ Salinity hazard, low to medium; sodium hazard, low.

Table 3. Analysis of irrigation water sample: Carson River above Lahontan Reservoir at intersection of highway alternate U.S. 95 and river[1/]

Date sampled	$EC \times 10^6$ @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
2/26/60	400	256	5.45	3.80	1.50	0.15	-	3.70	1.70	0.05	8.3	28	1	0	
3/30/60	290	186	3.45	2.30	1.04	.11	-	3.28	2.74	-	8.3	30	1	.98	
4/29/60	380	243	4.33	2.77	1.40	.16	-	4.15	3.13	-	8.6	32	1	1.38	
5/24/60	300	192	3.14	1.93	1.08	.13	-	3.37	1.62	-	8.1	34	1	1.44	
6/29/60	600	384	6.20	3.77	2.30	.13	0.48	3.45	.80	1.47	8.2	37	2	.16	2/
7/29/60	550	352	6.22	3.56	2.51	.15	.44	3.36	.56	1.86	8.5	40	2	.24	2/
11/9/60	690	442	7.47	4.70	2.64	.13	-	4.20	5.20	-	8.0	35	3	0	2/
1/4/61	470	301	4.55	2.86	1.60	.09	-	2.42	1.04	1.09	8.1	35	1	0	
2/8/61	450	288	4.49	2.74	1.66	.09	-	2.76	1.04	.69	8.2	37	1	.02	
3/6/61	450	288	3.94	2.46	1.40	.08	-	2.40	1.04	.50	8.3	36	1	0	
4/6/61	610	390	7.91	5.84	1.95	.12	-	3.64	1.24	3.03	8.0	25	1	0	
5/8/61	430	275	4.21	2.44	1.62	.15	-	2.70	.96	.55	8.2	38	1	.26	
4/2/62	260	166	2.71	1.77	.88	.06	-	3.55	.12	-	8.0	32	1	1.78	

1/ Salinity hazard, medium; sodium hazard, low.

2/ Very low flow

Table 4. Analysis of irrigation water sample: Lahontan Reservoir at shoreline near gate house[1/]

Date sampled	EC x 10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
12/1/60	430	275	3.96	2.16	1.66	0.14	-	2.40	1.38	0.18	8.2	42	2	0.24	
1/4/61	380	243	3.75	1.90	1.73	.12	-	2.20	1.16	.39	8.0	46	2	.30	
2/8/61	400	256	3.87	2.02	1.74	.11	-	2.42	1.30	.15	8.0	45	2	.40	
3/6/61	350	224	3.13	1.72	1.30	.11	-	2.20	1.28	-	8.3	42	1	.48	
4/6/61	350	224	3.21	1.76	1.34	.11	-	2.30	1.30	-	8.6	42	1	.54	
5/8/61	350	224	3.32	1.76	1.44	.12	-	2.42	1.10	-	8.5	43	2	.66	
4/2/62	430	275	4.07	2.13	1.82	.12	-	6.48	.63	-	7.9	45	2	4.35	
4/2/62	450	288	4.33	2.22	1.98	.13	-	5.09	1.05.	-	8.1	46	2	2.87	2/
6/27/62	300	192	2.44	1.51	.85	.08	-	3.30	.34	-	8.8	35	1	1.79	
6/27/62	330	211	2.64	1.63	.93	.08	-	3.30	.35	-	8.7	35	1	1.67	2/

1/ Salinity hazard, medium; sodium hazard, low.

2/ Sample taken at north shore boat landing.

Table 7. Analysis of irrigation water sample: Station 2 - "S" line canal, at intersection of Stillwater highway; downstream from station 1 [1/]

Date sampled	$EC \times 10^6$ @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.
8/5/59	350	224	3.76	2.18	1.44	0.14	-	2.97	1.50	-	8.2	38	1	0.79
9/4/59	410	262	4.05	2.26	1.64	.15	-	2.53	2.80	-	8.4	40	1	.27
10/4/59	470	301	4.21	2.30	1.79	.12	-	3.40	1.40	-	8.6	43	2	1.10
11/9/59	340	218	3.95	2.50	1.30	.15	-	4.00	2.70	-	8.3	33	1	1.50
3/30/60	240	154	2.75	1.54	1.10	.11	-	2.35	1.96	-	8.5	40	1	.81
4/29/60	290	186	3.25	1.87	1.24	.14	-	3.74	2.75	-	8.3	38	1	1.87
5/24/60	300	192	3.36	1.85	1.36	.15	-	3.12	2.36	-	8.2	40	1	1.27
6/29/60	360	230	3.70	1.95	1.61	.14	-	2.60	.70	0.40	8.0	44	2	.65
7/29/60	380	243	4.15	2.28	1.73	.14	-	2.12	.50	1.53	8.3	42	1	0
9/1/60	420	269	4.33	2.34	1.85	.14	-	2.50	1.06	.77	8.4	43	2	.16
10/4/60	430	275	4.24	2.30	1.80	.14	-	2.60	1.10	.54	8.9	42	2	.30
11/9/60	510	326	5.27	2.78	2.36	.13	-	2.80	1.22	1.25	8.5	45	2	.02
5/8/61	390	250	3.61	1.92	1.56	.13	-	2.30	1.30	.01	8.7	43	2	.38

1/ Salinity hazard, medium; sodium hazard, low.

Table 6. Analysis of irrigation water sample: Station 1 - Coleman Diversion; diverts water from Carson River into "S" Line Canal1/

Date sampled	ECx10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	350	224	3.89	2.31	1.44	0.14	-	2.32	1.00	0.57	8.2	37	1	0.01	
9/3/59	400	256	4.08	2.31	1.64	.13	-	2.64	1.50	-	8.5	40	2	.33	
10/4/59	540	346	5.44	3.10	2.21	.13	-	3.70	2.40	-	8.1	41	2	.60	
11/9/59	340	218	4.23	2.60	1.50	.13	-	3.80	2.40	-	8.4	35	1	1.20	
2/26/60	790	506	7.67	4.20	3.30	.17	-	4.73	2.14	.80	8.3	43	2	.53	2/ 3/
3/30/60	220	141	2.93	1.89	.93	.11	-	2.84	2.34	-	8.5	32	1	.95	4/
4/29/60	300	192	3.57	2.10	1.33	.14	-	3.58	2.63	-	8.3	37	1	1.48	
5/24/60	300	192	3.34	1.85	1.35	.14	-	3.15	2.50	-	8.1	40	1	1.30	
6/29/60	350	224	3.98	2.15	1.69	.14	-	2.60	.80	.58	8.0	42	2	.45	
7/29/60	400	256	4.13	2.24	1.75	.14	-	2.80	.80	.53	8.6	42	2	.56	
9/1/60	420	269	4.38	2.40	1.85	.13	-	2.60	1.10	.68	8.3	42	2	.20	
10/4/60	530	339	5.15	2.85	2.16	.14	-	2.88	1.26	1.01	8.6	42	2	.03	
11/9/60	540	346	5.48	2.96	2.40	.12	-	3.00	1.44	1.04	8.2	44	2	.04	
12/1/60	630	403	6.10	3.52	2.46	.12	-	3.24	1.30	1.56	8.2	40	2	0	3/
1/4/61	690	442	6.51	3.78	2.61	.12	-	3.40	1.46	1.65	8.0	40	2	0	5/
2/8/61	660	422	6.46	3.66	2.67	.13	-	3.42	1.54	1.50	8.3	41	2	0	
3/6/61	630	403	5.78	3.54	2.13	.11	-	3.10	1.24	1.44	8.1	37	2	0	
4/6/61	650	416	5.86	3.44	2.31	.11	-	3.24	1.44	1.18	8.3	39	2	0	
5/8/61	400	256	3.59	1.94	1.52	.13	-	2.56	1.34	-	8.2	42	1	.62	6/
4/2/62	730	467	7.42	4.06	3.24	.12	-	7.86	1.10	-	8.5	44	2	3.80	7/

1/ Salinity hazard, medium; sodium hazard, low.

2/ Very low flow

3/ Mostly drain water

4/ Irrigation water on since March 15, 1960.

5/ Water higher in salts during winter of 1960 and 1961 because of preceding drought.

6/ Irrigation water on since April 15, 1961.

7/ Sampled prior to start of 1962 irrigation season.

Table 5. Analysis of irrigation water sample: Carson River below Lahontan Reservoir outlet and below power house[1/]

Date sampled	$EC \times 10^6$ @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
9/3/59	370	237	3.72	2.15	1.44	0.13	0.44	1.98	1.50	-	8.5	39	2	0.27	
10/4/59	460	294	4.72	2.70	1.90	.12	-	3.10	2.60	-	8.5	40	2	.40	
11/9/59	460	294	5.91	3.60	2.10	.21	-	6.30	3.40	-	8.6	36	2	2.70	
2/26/60	250	160	5.13	3.90	1.10	.13	-	3.40	2.50	-	8.5	21	1	0	2/
3/30/60	250	160	2.60	1.39	1.10	.11	-	2.57	2.46	-	8.5	42	1	1.18	3/
4/29/60	280	179	4.28	2.77	1.35	.16	-	4.40	3.28	-	8.6	32	1	1.63	
5/24/60	300	192	3.13	1.61	1.37	.15	-	4.16	2.68	-	8.4	44	2	2.55	
6/29/60	330	211	3.36	1.74	1.49	.13	-	2.33	.90	0.13	8.1	44	2	.59	
7/29/60	340	218	3.59	1.94	1.52	.13	-	2.28	.68	.63	8.5	42	2	.34	
9/1/60	370	237	3.96	2.14	1.68	.14	-	2.60	1.20	.16	8.5	42	2	.46	
10/4/60	400	256	4.28	2.28	1.86	.14	-	2.58	1.10	.60	8.3	43	2	.30	
11/9/60	340	218	3.47	1.70	1.64	.13	-	2.40	1.16	-	8.4	47	2	.70	
12/1/60	250	160	2.38	1.40	.89	.09	-	1.98	1.00	-	8.3	37	1	.58	4/
5/8/61	350	224	3.31	1.74	1.44	.13	-	2.22	1.20	-	8.3	44	2	.48	5/
6/27/62	320	205	3.73	1.73	1.09	.10	-	4.13	.52	-	8.3	29	1	2.40	

1/ Salinity hazard, medium; sodium hazard, low.

2/ Very low flow, mostly Truckee Canal water.

3/ Water released from reservoir to begin irrigation season on March 15, 1960.

4/ Water in river all coming from Truckee Canal on this date; analysis identical with Truckee Canal.

5/ Water released from reservoir to begin irrigation season on April 15, 1961.

Table 8. Analysis of irrigation water sample: Station 3 - "S_2" line canal, at intersection of Triple E Lane: downstream from station 2[1/]

Date sampled	EC x 10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	410	262	5.39	2.38	2.85	0.16	-	2.75	1.50	1.14	8.6	53	3	0.37	
9/4/59	450	288	4.49	2.36	1.97	.16	-	2.86	3.00	-	8.4	44	2	.50	
10/4/59	540	346	5.40	2.60	2.64	.16	-	4.00	1.50	-	8.8	49	2	1.40	
11/9/59	400	256	4.58	2.50	1.90	.18	-	3.90	2.50	-	8.5	41	2	1.40	
3/30/60	500	320	5.32	2.17	2.93	.22	0.62	3.43	2.96	-	8.7	55	3	1.88	
4/29/60	340	218	4.96	3.08	1.71	.17	-	3.74	2.68	-	8.5	34	1	.66	
5/24/60	320	205	3.44	1.80	1.49	.15	-	4.16	3.64	-	8.3	43	2	2.36	
6/29/60	370	237	4.15	1.95	2.04	.16	-	2.46	.80	.89	8.2	49	2	.51	
7/29/60	400	256	4.13	2.20	1.79	.14	-	2.98	1.08	.07	8.4	43	2	.78	
9/1/60	470	301	4.56	2.36	2.05	.15	-	2.80	1.16	.60	8.5	45	2	.44	
10/4/60	540	346	5.41	2.54	2.68	.19	-	3.36	1.46	.59	8.9	50	2	.82	
11/9/60	500	320	5.20	2.54	2.52	.14	-	2.98	1.30	.92	8.7	48	2	.44	
12/1/60	600	384	5.76	2.72	2.88	.16	.24	3.56	1.64	.32	9.0	50	2	1.08	2/
5/8/61	420	269	4.15	1.96	2.04	.15	-	2.50	1.32	.33	8.5	49	2	.54	

1/ Salinity hazard, medium; sodium hazard, low.

2/ Very low flow - almost stagnant.

Table 9. Analysis of irrigation water sample: Station 4 - "V" line canal at intersection of Sheckler road cutoff[1/]

Date sampled	$EC \times 10^6$ @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	340	218	3.38	2.00	1.25	0.13	-	2.64	1.00	-	8.2	37	1	0.64	
9/3/59	390	250	3.68	2.10	1.44	.14	-	2.31	2.00	-	8.4	39	1	.21	
10/4/59	310	198	3.07	1.80	1.17	.10	-	2.60	1.20	-	8.3	38	1	.80	
11/9/59	210	134	2.93	1.90	.90	.13	-	3.10	3.60	-	8.4	31	1	1.20	2/
2/26/60	300	192	4.78	3.30	1.35	.13	-	3.21	2.70	-	8.2	28	1	0	3/
3/30/60	170	109	3.59	2.77	.72	.10	-	2.49	2.32	-	8.3	20	1	0	2/
4/29/60	270	173	3.29	1.95	1.20	.14	-	3.55	2.26	-	8.4	36	1	1.60	
5/24/60	260	166	3.20	1.58	1.49	.13	-	2.95	1.74	-	8.3	47	2	1.37	
6/29/60	320	205	3.73	1.87	1.73	.13	-	2.64	.60	0.49	7.8	46	2	.77	
7/29/60	350	224	3.73	2.10	1.51	.12	-	2.60	.92	.21	8.7	40	1	.50	
9/1/60	440	282	4.08	2.20	1.74	.14	-	2.60	1.16	.32	8.3	43	1	.40	
10/4/60	350	224	3.61	1.97	1.51	.13	-	2.44	1.06	.11	8.3	42	2	.47	
11/9/60	330	211	3.32	1.66	1.52	.14	-	2.40	1.18	-	8.3	46	2	.74	
12/1/60	290	186	2.88	1.60	1.18	.10	-	2.20	1.03	-	8.3	41	1	.60	
1/4/61	250	160	2.39	1.34	.96	.09	-	1.82	1.00	-	8.1	40	1	.48	
2/8/61	380	243	3.67	1.82	1.72	.13	-	2.64	1.50	-	8.6	47	2	.82	
3/6/61	240	154	2.36	1.40	.88	.08	-	1.84	0.86	-	8.4	37	1	.44	
4/6/61	290	186	2.66	1.44	1.12	.10	-	2.20	1.16	-	9.3	42	1	.76	
5/8/61	350	224	3.26	1.76	1.38	.12	-	2.26	1.20	-	8.1	42	1	.50	
4/2/62	270	173	2.70	1.46	1.17	.07	-	4.01	0.49	-	8.3	43	1	2.55	

1/ Salinity hazard, medium; sodium hazard, low.

2/ High flow.

3/ Low flow.

Table 10. Analysis of irrigation water sample: Station 5 - "AA" line canal 0.5 mile east of highway U.S. 95; downstream from Station 4[1/]

Date sampled	EC x 10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.
8/5/59	350	224	3.68	2.10	1.44	0.14	-	2.86	2.00	-	8.2	39	1	0.76
9/4/59	410	262	4.10	2.21	1.75	.14	-	2.75	2.50	-	8.4	43	2	.54
10/4/59	310	198	3.08	1.80	1.17	.11	-	2.70	1.10	-	8.6	38	1	.90
11/9/59	400	256	4.63	2.30	2.10	.23	-	4.20	3.00	-	8.3	45	2	1.90
3/30/60	380	243	6.03	3.59	2.22	.22	-	4.38	2.56	-	8.6	37	2	.79
4/29/60	270	173	3.47	2.00	1.30	.17	-	3.93	2.73	-	8.5	37	1	1.93
5/24/60	290	186	3.20	1.70	1.33	.17	-	3.61	3.84	-	8.4	42	2	1.91
6/29/60	400	256	5.15	2.73	2.21	.21	0.18	2.73	.80	1.44	7.8	43	2	.18
7/29/60	370	237	3.90	2.02	1.74	.14	-	2.70	.64	.56	8.7	45	2	.68
9/1/60	430	275	4.49	2.32	2.00	.17	-	2.60	1.28	.61	8.4	45	2	.28
10/4/60	540	346	5.59	2.44	2.92	.23	-	3.24	1.50	.85	8.8	52	3	.80
11/9/60	290	186	2.96	1.58	1.25	.13	-	2.00	1.00	-	8.3	42	1	.42
5/8/61	480	307	4.68	1.90	2.60	.18	-	2.90	1.74	.04	8.8	56	1	1.00

1/ Salinity hazard, medium; sodium hazard, low.

Table 11. Analysis of irrigation water sample: Station 6 - "L" line canal, at intersection of highway U.S. 95; downstream from station 4[1/]

Date sampled	EC x 10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	330	211	4.36	2.97	1.25	0.14	-	1.98	1.50	0.88	8.3	29	1	0	
9/3/59	390	250	3.67	2.10	1.44	.13	-	2.42	2.00	-	8.6	39	1	.32	
10/4/59	290	186	2.78	1.70	0.98	.10	-	2.40	1.20	-	8.4	35	1	.70	
11/9/59	240	154	3.13	2.10	0.90	.13	-	3.10	2.10	-	8.2	29	1	1.00	
2/26/60	300	192	4.07	2.60	1.32	.15	-	3.48	2.44	-	8.2	32	1	.88	
3/30/60	190	122	3.80	2.93	0.77	.10	-	2.55	2.52	-	8.3	20	1	0	
4/29/60	250	160	3.58	2.33	1.12	.13	-	3.77	2.58	-	8.5	31	1	1.44	
5/24/60	260	166	2.85	1.58	1.14	.13	-	3.01	2.46	-	8.3	40	1	1.43	
6/29/60	310	198	3.45	1.74	1.59	.12	-	2.40	1.16	-	8.4	46	2	.66	
7/29/60	350	224	4.13	2.48	1.53	.12	-	2.20	1.00	.93	8.9	37	1	0	
9/1/60	400	256	3.91	2.08	1.69	.14	-	2.40	1.20	.31	8.4	43	2	.32	
10/4/60	350	224	3.54	1.94	1.48	.12	-	2.48	1.00	.06	8.6	42	1	.54	
11/9/60	290	186	2.92	1.56	1.24	.12	-	2.00	.80	.12	8.2	42	1	.44	
12/1/60	280	179	2.77	1.54	1.13	.10	-	2.04	1.04	-	8.5	41	1	.50	
1/4/61	260	166	2.46	1.34	1.03	.09	-	1.82	.90	-	8.4	42	1	.48	
2/8/61	400	256	3.81	1.84	1.84	.13	-	2.56	1.54	-	8.9	48	2	.72	2/
3/6/61	320	205	2.95	1.50	1.36	.09	-	2.20	1.46	-	9.1	46	2	.70	2/
4/6/61	290	186	2.56	1.44	1.02	.10	-	2.20	1.16	-	9.2	40	1	.76	
5/8/61	350	224	3.48	1.92	1.44	.12	-	2.20	1.16	.12	8.3	41	1	.28	
4/2/62	290	186	2.82	1.50	1.24	.08	-	4.47	.44	-	8.6	44	1	2.97	

1/ Salinity hazard, medium; sodium hazard, low.

2/ Low flow.

Table 12. Analysis of irrigation water sample: Station 7 - Carson River at Sagouspa Diversion dam; downstream from Station 1. River at this point contains a large amount of drainage water[1/]

Date sampled	EC x 10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	520	333	6.39	2.31	3.90	0.18	0.32	2.54	2.50	1.03	8.3	61	4	0.55	
9/3/59	780	499	7.08	2.77	4.10	.21	.88	3.30	3.00	-	8.7	58	4	1.41	
10/4/59	900	576	6.47	3.00	3.25	.22	.40	4.40	2.70	-	8.3	50	3	1.80	
11/9/59	800	512	8.62	3.30	5.00	.32	-	5.00	3.60	.02	8.5	58	4	1.70	
2/26/60	3800	2432	35.46	6.80	27.80	.86	.79	6.89	14.30	13.48	8.5	78	14	.88	2/
3/30/60	720	461	7.55	3.12	4.20	.23	-	2.07	4.20	1.28	8.6	56	3	0	
4/29/60	810	518	8.01	2.82	5.10	.09	.55	4.70	4.70	-	8.7	64	4	2.43	
5/24/60	940	602	7.24	2.87	4.26	.11	1.23	3.85	3.94	-	8.5	59	3	2.21	
6/29/60	820	525	8.70	2.67	5.70	.33	.48	1.74	1.72	4.76	8.3	66	5	0	
7/29/60	600	384	6.50	2.50	3.79	.21	-	3.70	1.20	1.60	8.6	58	3	1.20	
9/1/60	820	525	8.32	2.86	5.22	.24	-	4.46	2.48	1.38	8.4	63	4	1.60	
10/4/60	830	531	7.96	2.72	5.01	.23	.76	3.60	2.10	1.50	8.8	63	4	1.64	
11/9/60	1290	826	12.58	3.42	8.80	.36	-	5.64	3.58	3.36	8.4	70	6	2.22	
12/1/60	1980	1267	17.69	4.46	12.78	.45	-	6.42	6.14	5.13	8.3	72	9	1.96	3/
1/4/61	2200	1408	20.46	4.85	15.29	.32	-	7.50	8.66	4.30	8.1	75	10	2.65	3/
2/8/61	4600	2944	43.97	6.15	36.96	.86	-	8.50	20.80	14.67	8.6	84	23	2.35	3/
3/6/61	7300	5110	71.92	7.20	63.60	1.12	-	11.00	35.50	25.42	8.8	88	30	3.80	3/
4/6/61	4300	2752	36.04	5.90	29.44	.70	-	7.10	17.75	11.19	8.7	82	17	1.20	2/
5/8/61	870	557	7.94	2.45	5.24	.25	-	3.95	4.25	-	8.8	66	4	1.50	4/
4/2/62	3700	2368	37.48	5.93	31.00	.55	.93	14.34	16.82	5.39	9.0	83	18	9.34	2/

1/ Salinity hazard, high to very high; sodium hazard, low to very high.

2/ All drain water.

3/ Mostly drain water.

4/ Irrigation water on April 15, 1961.

Table 13. Analysis of drainage water sample: Station 8 - New River drain, above diversion into "L" line canal; downstream from Station 9 [1/]

Date sampled	ECx10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
2/26/60	900	576	10.89	5.50	5.00	0.39	2.02	5.10	2.90	0.87	9.0	46	3	1.62	2/
3/30/60	610	390	6.77	3.08	3.36	.33	.84	7.50	3.00	-	9.1	50	3	5.26	
4/29/60	780	499	8.34	3.92	4.32	.10	.66	6.29	2.98	-	8.8	52	3	3.03	
5/24/60	630	403	6.58	3.08	3.36	.14	.70	5.52	2.06	-	8.4	51	3	3.14	
6/29/60	500	320	5.53	2.40	2.90	.23	.44	3.43	.60	1.06	8.2	52	3	1.47	
7/29/60	620	397	7.19	3.42	3.52	.25	-	5.04	1.70	.45	8.8	49	3	1.62	
9/1/60	640	410	6.88	3.24	3.42	.22	-	4.90	1.76	.22	8.3	50	3	1.56	
10/4/60	800	512	7.91	3.58	4.11	.22	.36	5.40	1.52	.63	8.5	52	3	2.18	
11/9/60	880	563	8.82	3.90	4.68	.24	-	5.80	1.70	1.32	8.5	53	3	1.90	
12/1/60	890	570	8.59	4.04	4.29	.26	.40	5.46	1.66	1.07	8.4	50	3	1.82	3/
1/4/61	910	582	8.43	3.90	4.30	.23	-	6.15	2.40	-	8.1	51	3	2.25	
2/8/61	930	595	9.13	3.85	5.00	.28	-	6.55	2.70	-	8.8	55	4	2.29	
3/6/61	900	576	8.21	3.35	4.64	.22	-	6.50	2.35	-	8.8	57	4	3.15	
4/6/61	920	589	8.82	3.85	4.68	.29	-	6.65	2.75	-	8.7	53	3	2.80	
5/8/61	760	486	7.24	3.04	3.92	.28	-	5.00	1.86	.38	8.5	54	3	1.96	
4/2/62	920	589	9.33	3.73	5.40	.20	.93	13.26	.66	-	8.9	58	4	10.46	

1/ Salinity hazard, medium to high; sodium hazard, low.

2/ Analysis shows more seasonal variations here than further upstream at Station 9.

3/ Concentration of salts higher in winter months during low water flow.

Table 14. Analysis of drainage water sample: Station 9 - New River extension drain at intersection of drain and Taylor Street in Fallon[1/]

Date sampled	$EC \times 10^6$ @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	690	442	7.29	3.67	3.44	0.18	0.32	4.74	1.50	0.73	8.3	47	3	1.39	2/
9/4/59	720	461	7.11	3.74	3.25	.12	.32	5.40	2.00	-	8.6	46	2	1.98	
10/9/59	750	480	8.44	4.90	3.40	.14	-	6.00	2.70	-	8.1	40	2	1.10	
11/9/59	740	474	7.95	3.90	3.80	.25	.88	5.34	2.00	-	8.9	48	3	2.32	
2/26/60	780	499	8.44	4.40	3.70	.34	-	5.90	3.20	-	8.5	44	2	1.50	
3/30/60	740	474	9.93	5.93	3.77	.23	-	7.08	2.72	.13	8.7	38	2	1.15	
4/29/60	700	448	7.65	3.97	3.45	.23	.72	6.34	3.83	-	8.8	45	2	3.09	
5/24/60	700	448	7.70	3.86	3.74	.10	1.50	4.60	2.64	-	8.2	49	3	2.24	
6/29/60	600	384	7.09	3.40	3.50	.19	.70	4.66	0.90	.83	7.8	49	3	1.96	
7/29/60	700	448	7.75	3.78	3.79	.18	.64	4.42	1.50	1.19	8.8	49	3	1.28	
9/1/60	730	467	7.53	3.84	3.58	.11	-	5.60	1.60	.33	8.2	48	3	1.76	
10/4/60	740	474	7.38	3.86	3.36	.16	-	5.44	1.36	.58	8.0	46	2	1.58	
11/9/60	730	467	7.60	3.96	3.48	.16	-	5.38	1.32	.90	8.1	46	2	1.42	
12/1/60	770	493	7.38	4.20	3.00	.18	-	5.56	1.36	.46	7.9	41	3	1.36	
1/4/61	780	499	7.77	4.25	3.36	.16	-	5.60	1.75	.42	8.0	43	2	1.35	
2/8/61	750	480	7.92	4.26	3.48	.18	-	5.82	1.58	.52	8.1	44	2	1.56	
3/6/61	780	499	7.47	4.06	3.24	.17	-	5.70	1.32	.45	8.1	43	2	1.64	
4/6/61	790	506	7.57	4.06	3.36	.15	-	5.80	1.44	.33	8.3	44	2	1.74	
5/8/61	700	448	6.75	3.36	3.18	.21	-	5.00	1.46	.29	8.1	47	2	1.64	
4/2/62	700	448	8.13	4.40	3.57	.16	-	13.26	1.57	-	8.2	44	2	10.50	

1/ Salinity hazard, medium; sodium hazard, low.

2/ Water quality is remarkably constant at this station.

Table 15. Analysis of drainage water sample: Station 10 - Harmon drain at intersection of triple "E" lane; actually upper end of Stillwater slough[1/]

Date sampled	$EC \times 10^6$ @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	CO_3^{+}	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	1100	704	10.24	3.77	6.20	0.27	0.54	3.86	4.00	1.84	8.8	61	4	0.63	
9/4/59	1130	723	10.32	4.05	6.00	.27	.88	4.51	5.00	-	8.8	58	4	1.34	
10/9/59	2080	1331	22.32	5.20	16.80	.32	-	8.90	9.60	3.82	8.4	75	10	3.70	
11/9/59	2140	1370	20.95	6.20	14.20	.55	-	6.97	9.70	4.25	8.2	68	8	.77	
2/26/60	4000	2560	43.24	8.20	34.40	.64	-	7.66	21.30	14.28	8.5	80	17	0	
3/30/60	1590	1018	15.69	5.21	10.14	.34	-	6.40	9.22	0.07	8.6	65	6	1.19	
4/29/60	2100	1344	20.11	5.44	14.19	.48	.77	5.24	10.65	3.11	8.8	71	9	0	
5/24/60	2050	1312	19.11	5.23	13.80	.08	1.72	4.31	8.24	3.98	8.5	72	9	0	
6/29/60	950	608	9.78	3.08	6.38	.32	.57	3.61	2.70	2.90	7.7	65	5	1.10	
7/29/60	1200	768	11.25	3.86	7.08	.31	.48	3.64	4.90	2.23	8.9	63	5	.26	
9/1/60	1200	768	10.27	3.76	5.85	.66	-	4.24	4.88	1.15	8.1	57	4	.48	
10/4/60	2150	1376	18.36	4.66	13.31	.39	.76	4.04	8.84	4.72	8.7	72	9	.14	
11/9/60	2900	1856	23.10	3.05	19.58	.47	-	5.20	13.32	4.58	8.4	75	16	2.15	
12/1/60	3850	2464	30.48	7.43	22.40	.65	-	6.05	18.40	6.03	8.4	73	12	0	
1/4/61	5000	3200	46.52	9.10	36.75	.67	-	6.90	30.90	8.72	8.4	79	17	0	
2/8/61	4750	3040	40.69	7.80	32.34	.55	-	6.45	25.40	8.84	8.4	79	11	0	
3/6/61	6000	4200	53.89	10.50	42.70	.69	-	8.00	39.70	6.19	8.5	79	18	0	2/
4/6/61	6700	4690	63.56	10.20	52.50	.86	-	8.90	46.00	8.66	8.8	83	22	0	2/
5/8/61	2600	1664	21.12	4.75	15.84	.53	-	5.50	12.50	3.12	8.5	75	10	.75	
4/2/62	5100	3570	55.57	9.34	45.50	.73	-	12.80	29.76	13.01	8.5	82	20	3.46	

1/ Salinity hazard, high to very high; sodium hazard, low to very high.

2/ Low flow.

Table 16. Analysis of drainage water sample: Station 11 - Carson Lake drain, 0.5 mile east of highway U.S. 95 carries water from West Side drain, Upper Diagonal drain or Mills drain, depending upon direction of upstream diversion[1/]

Date sampled	EC x 10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	630	403	7.05	3.05	3.43	0.57	0.54	4.08	2.00	0.43	8.9	49	2	1.57	
9/4/59	650	416	7.22	3.08	3.90	.24	.10	5.07	5.00	-	8.6	54	3	2.09	
10/9/59	690	442	7.62	3.90	3.50	.22	-	5.50	3.90	-	8.1	46	2	1.60	
11/9/59	630	403	6.79	3.30	3.10	.39	-	5.70	2.30	-	8.4	46	2	2.40	
2/26/60	800	512	9.92	5.00	4.50	.42	-	7.50	3.30	-	8.6	45	3	2.50	
3/30/60	600	384	7.37	3.77	3.26	.34	-	5.81	2.72	-	8.7	44	2	2.04	
4/29/60	700	448	7.29	3.64	3.54	.11	.55	5.29	3.70	-	8.9	49	3	2.20	
5/24/60	720	461	7.33	3.69	3.50	.14	.79	5.26	2.90	-	8.6	48	3	2.35	
6/29/60	520	333	6.03	2.60	3.22	.21	.40	3.54	0.80	1.29	8.1	53	3	1.34	
7/29/60	570	365	6.01	2.76	3.01	.24	-	3.86	1.16	.99	8.8	50	2	1.10	
9/1/60	640	410	6.68	3.32	3.12	.24	-	4.60	1.56	.52	8.1	47	2	1.28	
10/4/60	760	486	7.34	3.74	3.36	.24	.32	4.78	1.40	.84	8.5	46	2	1.36	
11/9/60	780	499	7.98	3.96	3.78	.24	-	5.40	1.34	1.24	8.2	47	3	1.44	
12/1/60	800	512	7.72	3.62	3.78	.32	-	5.60	1.30	.82	8.5	49	3	1.98	
1/4/61	870	557	8.20	3.55	4.38	.27	-	6.10	2.25	-	8.2	53	3	2.55	
2/8/61	800	512	8.18	3.36	4.56	.26	-	5.80	1.64	.74	8.6	56	4	2.44	
3/6/61	890	570	7.90	3.54	4.08	.28	-	6.00	1.50	.40	8.5	52	3	2.46	2/
4/6/61	890	570	8.35	3.50	4.52	.33	-	6.45	2.75	-	8.6	54	3	2.95	2/
5/8/61	720	461	6.86	3.00	3.57	.29	-	4.90	1.50	.46	8.6	52	3	1.90	
4/2/62	820	525	8.96	3.30	5.35	.31	-	13.11	1.19	-	8.6	60	4	9.81	

1/ Salinity hazard, medium to high; sodium hazard, low.

2/ Low flow.

Table 17. Analysis of drainage water sample: Station 12 - Upper Diagonal drain, at SW corner of Naval Air Base downstream from Station 15; could carry water from West Side drain[1/]

Date sampled	ECx10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	910	582	6.05	3.15	2.77	0.13	0.20	3.98	4.00	-	8.5	46	2	1.03	
9/4/59	820	525	7.26	2.97	4.05	.24	.54	4.74	2.50	-	8.3	56	3	2.31	
10/9/59	750	480	5.33	2.50	2.60	.23	-	4.80	3.70	-	8.6	49	2	2.30	
11/9/59	600	384	6.58	2.60	3.70	.28	-	4.90	3.10	-	8.1	56	3	2.30	
2/26/60	1570	1005	16.60	5.40	10.70	.50	-	8.40	5.50	2.70	8.6	64	7	3.00	
3/30/60	980	627	10.75	3.90	6.62	.23	-	6.23	3.86	0.66	8.6	62	5	2.33	
4/29/60	700	448	-	2.51	-	.35	.50	5.01	3.33	-	8.4	-	-	3.00	
5/24/60	1200	768	11.82	3.49	7.92	.41	1.94	4.40	3.54	.97	8.4	67	6	2.85	
6/29/60	760	486	7.95	2.44	5.26	.25	.44	3.83	1.20	2.48	8.0	66	4	1.83	
7/29/60	880	563	8.93	3.18	5.48	.27	.88	4.48	1.46	2.11	8.6	61	4	2.18	
9/1/60	780	499	8.01	3.10	4.68	.23	-	4.36	1.84	1.81	8.2	58	4	1.26	
10/4/60	1170	749	11.01	3.22	7.50	.29	.40	5.20	2.28	3.13	8.6	68	6	2.38	
11/9/60	1210	774	12.22	3.66	8.28	.28	.06	5.72	2.54	3.90	8.5	68	6	2.12	
12/1/60	1250	800	11.43	4.00	7.08	.35	-	6.04	2.48	2.91	8.4	62	5	2.04	
1/4/61	1270	813	12.02	4.10	7.62	.30	-	7.00	3.35	1.67	8.0	63	5	2.90	
2/8/61	1420	909	14.08	4.00	9.78	.30	-	7.10	4.15	2.83	8.4	69	7	3.10	
3/6/61	2030	1299	18.29	4.30	13.68	.31	-	7.50	6.00	4.79	8.3	75	9	3.20	2/
4/6/61	9500	6650	81.33	11.80	68.64	.89	.60	9.60	37.30	33.83	8.7	84	30	0	3/
5/8/61	1200	768	10.99	3.00	7.74	.25	-	4.90	4.25	1.84	8.9	70	6	1.90	
4/2/62	7700	5390	86.22	12.18	73.00	1.04	1.85	15.87	18.30	50.20	8.5	85	30	5.54	

1/ Salinity hazard, high; sodium hazard, low to very high.

2/ Low flow.

3/ Very low flow and of extremely poor quality.

Table 18. Analysis of drainage water sample: Station 13 - Douglas ("GF") drain extension. Constructed in 1952 in highly saline, alkaline land. Sampled where drain turns from southern to eastern direction[1/]

Date sampled	$EC \times 10^6$ @25°C	Total salts	Sum of cations	$\frac{Ca^{++}}{Mg^{++}}$	Na^+	K^+	$CO_3^=$	HCO_3^-	Cl^-	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	65,000	45,500	455.54	69.74	380.00	5.80	4.62	12.65	342.50	95.77	9.1	83	30	0	
9/4/59	590	378	5.59	2.67	2.63	.29	3.52	6.71	3.00	-	8.4	47	2	7.56	2/
10/9/59	3,980	2,547	210.80	33.50	175.10	2.20	5.32	15.33	165.20	24.95	9.1	83	30	0	
11/9/59	5,690	3,983	49.30	8.00	40.20	1.10	2.11	7.99	27.80	11.40	8.5	82	19	2.10	
2/26/60	15,300	10,710	134.80	16.80	116.00	2.00	1.67	15.30	88.40	29.43	8.4	86	30	.17	
3/30/60	4,010	2,566	38.47	7.69	30.10	.68	.62	8.18	22.10	7.57	8.6	22	15	1.11	3/
4/29/60	2,250	1,440	20.36	3.92	16.39	.05	.86	5.07	13.55	.88	8.8	81	12	2.01	3/
5/24/60	7,200	5,040	61.66	8.05	53.55	.06	6.56	5.04	41.24	8.82	9.0	87	23	3.55	
6/29/60	18,000	12,600	219.47	30.97	186.15	2.35	2.09	8.97	139.50	68.91	8.1	85	30	0	
7/29/60	520	333	6.10	2.82	3.00	.28	-	4.04	1.00	1.06	8.8	49	2	1.22	2/
9/1/60	1,700	1,088	15.01	3.42	11.31	.28	-	6.56	6.78	1.67	8.2	75	9	3.14	3/
10/4/60	10,500	7,350	84.48	12.54	70.89	1.05	1.60	8.58	56.78	17.52	8.6	84	30	0	
11/9/60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4/
12/1/60	32,400	22,680	261.66	33.50	224.96	3.20	2.50	8.60	189.60	60.96	8.3	86	30	0	
1/4/61	20,500	14,350	169.73	25.10	142.74	1.89	-	15.50	131.00	23.23	8.0	84	30	0	
2/8/61	20,500	14,350	180.10	26.10	152.28	1.72	-	17.00	135.80	27.30	8.1	85	30	0	
3/6/61	27,600	19.320	215.14	25.70	187.50	1.94	2.00	23.00	159.00	31.14	8.4	87	30	0	
4/6/61	1,320	845	11.33	2.80	8.16	.37	-	7.10	6.70	-	8.8	72	7	4.30	3/
5/8/61	7,000	4,900	56.88	7.30	48.60	.98	-	13.10	40.50	3.28	8.5	85	28	5.80	
4/2/62	42.400	29.680	436.80	66.00	366.00	4.80	4.63	46.25	318.33	67.59	7.8	84	20	0	

1/ Salinity hazard, extremely high; sodium hazard, very high.
2/ Mostly irrigation water.
3/ Some irrigation water.
4/ No sample taken.
Note: Water from this drain is not used for irrigation.

Table 19. Analysis of drainage water sample: Station 14 - Lower Soda Lake drain, adjacent to intersection of Bafford Lane and Lovelock cutoff[1/]

Date sampled	ECx10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
8/5/59	800	512	7.85	1.69	5.90	0.26	2.42	2.20	2.50	0.73	9.0	75	7	2.93	
9/4/59	1100	704	9.24	2.20	6.75	.29	.44	3.41	2.00	3.39	8.3	73	7	1.65	
10/9/59	1130	723	11.16	4.00	6.90	.26	2.20	4.09	2.90	1.97	8.7	62	5	2.29	
11/9/59	1100	704	12.03	3.10	8.50	.43	1.20	6.89	3.40	.54	8.5	71	7	4.99	
2/26/60	1230	787	14.72	4.50	9.80	.42	2.00	6.40	3.80	2.52	8.8	67	6	3.90	
3/30/60	1030	659	11.04	3.55	7.05	.44	2.60	4.25	3.62	.57	9.0	64	5	3.30	
4/29/60	1020	653	11.40	3.28	8.01	.11	2.20	5.57	5.23	-	9.1	70	6	4.49	
5/24/60	970	621	10.87	2.91	7.86	.10	1.89	5.19	3.10	.69	9.2	72	6	4.17	
6/29/60	890	570	9.58	2.54	6.82	.22	.62	5.30	1.74	1.92	8.5	71	6	3.38	
7/29/60	820	525	8.80	1.90	6.60	.30	.72	5.52	1.52	1.04	8.9	75	7	4.34	
9/1/60	820	525	8.32	2.70	5.34	.28	.40	5.18	1.68	1.06	8.4	64	4	2.88	
10/4/60	920	589	9.06	2.86	5.95	.25	.48	5.52	1.62	1.44	8.8	66	5	3.14	
11/9/60	990	634	9.86	2.60	7.00	.26	-	6.50	1.84	1.52	8.5	71	6	3.90	
12/1/60	1000	640	9.89	2.85	6.72	.32	-	7.00	2.50	.39	8.7	68	6	4.15	
1/4/61	1360	870	11.87	2.90	8.64	.33	-	8.10	3.25	.52	8.5	73	7	5.20	
2/8/61	1200	768	11.91	2.70	8.90	.31	-	8.05	3.65	.21	8.8	75	8	5.35	2/
3/6/61	1370	877	11.55	2.60	8.70	.25	-	7.55	3.25	.75	8.8	75	8	4.95	
4/6/61	1350	864	13.41	2.60	10.50	.31	.30	7.90	3.90	1.31	9.0	78	9	5.60	
5/8/61	1130	723	10.60	2.50	7.80	.30	-	7.00	3.00	.60	9.0	74	7	4.50	
4/2/62	1300	832	13.01	3.03	9.70	.28	-	18.04	1.94	-	8.7	75	8	15.01	

1/ Salinity hazard, high; sodium hazard, low to medium.

2/ Salt and sodium concentrations higher during winter of 1960 and 1961 due to preceding drought; high in April 1962 for same reason.

Table 20. Analysis of drainage water sample: Station 15 - Mills drain, at intersection of Sheckler Road cutoff[1/] [2/]

Date sampled	EC$\times 10^6$ @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	Other anions	pH	SSP	SAR	RSC
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.
8/5/59	590	378	6.35	3.74	2.40	0.21	0.98	3.42	2.00	-	8.3	38	2	0.66
9/3/59	580	371	6.02	3.49	2.35	.18	.88	4.18	1.00	-	8.8	39	2	1.57
10/9/59	600	384	7.14	4.70	2.30	.14	-	5.20	2.20	-	8.2	32	1	.50
11/9/59	600	384	8.45	5.90	2.30	.25	-	6.10	1.80	0.55	8.4	27	1	.20
2/26/60	560	358	6.77	4.20	2.35	.22	.75	4.40	2.20	-	8.6	35	2	.95
3/30/60	530	338	7.10	4.59	2.29	.22	.88	4.55	2.90	-	8.8	32	1	.84
4/29/60	520	333	7.08	4.46	2.44	.18	.72	3.74	3.15	-	8.6	34	2	0
5/24/60	530	339	6.09	3.55	2.44	.10	1.36	4.58	1.74	-	8.7	40	2	2.39
6/29/60	500	320	5.51	3.08	2.28	.15	.53	4.31	.90	-	8.2	41	2	1.76
7/29/60	510	326	6.20	3.52	2.51	.17	-	5.12	1.08	-	8.4	40	2	1.60
9/1/60	550	352	5.49	3.56	1.78	.15	.40	4.20	1.36	-	8.5	32	1	1.04
10/4/60	560	358	6.13	3.70	2.28	.15	-	4.60	1.50	.03	8.2	37	2	.90
11/9/60	600	384	6.32	3.66	2.50	.16	-	4.76	1.34	.22	8.2	40	2	1.10
12/1/60	580	371	6.07	3.80	2.10	.17	-	4.80	1.04	.23	8.4	35	2	1.00
1/4/61	610	390	5.97	3.75	2.07	.15	-	5.00	2.05	-	8.1	35	2	1.25
2/8/61	590	378	6.10	3.54	2.40	.16	.24	4.27	1.32	.27	9.0	39	2	.97
3/6/61	610	390	5.70	3.50	2.06	.14	-	4.58	1.18	-	8.8	36	2	1.08
4/6/61	580	371	5.92	3.46	2.28	.18	.36	4.08	1.40	.08	9.1	39	2	.98
5/8/61	600	384	5.56	3.32	2.04	.20	-	4.63	1.46	-	8.8	37	2	1.31
4/2/62	700	448	7.31	4.15	3.00	.16	-	11.10	1.26	-	8.4	41	2	6.95

1/ Salinity hazard, medium; sodium hazard, low.

2/ Water quality is remarkably constant at this location.

Table 21. Analysis of drainage water sample: Station 16 - Gummow drain at diversion into "G" line irrigation canal[1/]

Date sampled	ECx10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^+	K^+	$CO_3^=$	HCO_3^-	Cl^-	Other anions	pH	SSP	SAR	RSC
	µmohs/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.
4/2/62	1020	653	9.85	2.90	6.55	0.40	-	13.88	2.15	-	8.8	66	5	10.98

1/ Salinity hazard, high; sodium hazard, low.

Table 22. Analysis of irrigation waters: Storage reservoirs in Lahontan Valley[1/]

Date sampled	ECx10^6 @25°C	Total salts	Sum of cations	Ca^{++} Mg^{++}	Na^+	K^+	$CO_3^=$	HCO_3^-	Cl^-	Other anions	pH	SSP	SAR	RSC	Notes
	µmhos/cm	p.p.m.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.	Meq./l.				Meq./l.	
4/2/62	1000	640	10.26	2.99	7.10	0.17	-	9.87	2.20	-	8.7	69	6	6.88	2/
4/2/62	740	473	7.26	3.79	3.32	.15	-	8.33	.89	-	8.4	46	2	4.54	3/
4/2/62	720	461	6.93	2.76	4.00	.17	-	9.10	1.45	-	8.5	58	3	6.34	4/
4/2/62	540	346	5.39	2.36	2.92	.11	-	6.94	.96	-	8.8	54	3	4.58	5/

1/ Salinity hazard, medium to high; sodium hazard, low.

2/ Ole's Ponds Reservoir

3/ "S" Line Regulating Reservoir.

4/ Harmon Reservoir.

5/ Sheckler Reservoir.

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